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## (54) VEHICLE STEERING COLUMN ADJUSTMENT AND ENERGY ABSORBING MECHANISM

EINSTELL- UND ENERGIEAUFNAHMEMECHANISMUS FÜR EINE  
KRAFTFAHRZEUGLENKSÄULEREGLAGE DE COLONNE DE DIRECTION DE VEHICULE ET MECANISME D'ABSORPTION  
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**Description**

This invention relates to a vehicle steering column adjustment and energy absorbing mechanism, such as defined in the preamble of claim 1 and known for example from WO-A-9400327.

Steering columns are known which incorporate locking mechanisms to allow for manual longitudinal, reach-adjustment of the steering wheel relative to the driver. Energy absorbing systems are also known to be incorporated in steering columns to absorb energy in the event of a frontal crash of the vehicle to inhibit severe injury to the driver.

It is an object of the present invention to combine a steering column adjustment mechanism and an energy absorbing steering column collapse mechanism which allows normal steering column adjustment whilst allowing direct energy absorption in the event of crash regardless of the normal steering column adjustment location.

According to the present invention, there is provided a vehicle steering column adjustment and energy absorbing mechanism comprising a steering column part slidably mounted in a support member, said steering column part carrying first locking means for releasable engagement with second locking means, characterised in that it comprises cam means to cause said first and second locking means to engage with one another to lock the steering column relatively to said support member; said second locking means being joined to an energy absorbing device comprising an elongate member arranged around a further member over which said elongate member can be drawn, the arrangement being such that, in normal use, said steering column part can be slidably adjusted relative to said support member and locked in a desired position by said first and second locking means and, in the event of vehicle crash with said first and second locking means locked together, energy imparted to said steering column part moves said steering column part to cause said first and second locking means to draw said elongate member around said further member, thereby to absorb energy; and there being means for maintaining said first and second locking means in locking engagement in the event of a vehicle crash.

The means for maintaining the first and second locking means in locking engagement can be the support member, which has a platform portion. The platform portion can be a raised portion of the support member.

The steering column part can be an outer tube or shaft of the steering column.

The support member can be a tubular housing which is rigidly attached to the vehicle.

The first locking means can be a rack fixed to the steering column part and the second locking means can be a toothed slipper for releasable engagement with the rack.

5 The cam means can be an integral part of a pivot shaft to which an actuating member, preferably a lever, is attached in order to rotate the cam means to bring the second locking means into and out of engagement with the first locking means.

A spring can be interposed between the cam means and the locking means to transfer and distribute force applied by the cam means to the locking means.

10 Resilient means can be provided between the two locking means to urge the second locking means out of engagement with the first locking means when the cam means is positioned to allow this to happen.

Preferably, the elongate member of the energy absorbing device is joined to the second locking means.

15 The energy absorbing elongate member can be a metal strap or wire.

The aforesaid further member over which the elongate member can be drawn can be a pin or the like fixed relatively to the support member.

20 Stop means can be provided to limit adjustment of the steering column part relatively to the support member in which it is mounted. One stop member may be provided by a collapsible tab on the steering column part which, at one adjustment limit comes into contact with part of the support member. Another stop member for an opposite adjustment limit of the steering column part can be provided by the locking means, part of which being arranged to abut the same part of the support member.

25 30 For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:-

35 Figure 1 is a sectional side view of part of a vehicle steering column and illustrating a steering column adjustment and energy absorbing mechanism, taken on line C-C of Figure 2,

40 Figure 2 is an end sectional view taken on the line A-A in Figure 1, and

45 Figure 3 is an end sectional view taken along the line B-B of Figure 1.

Referring to the drawings, a vehicle steering column adjustment and energy absorbing mechanism is illustrated which includes a steering column part in the form of a steering column outer tube 1 which is axially slidably in a support member in the form of a housing 2 which is fixed to the body of the vehicle (not shown).

The outer tube 1 carries a first part of a locking means in the form of a fixedly attached toothed rack 3. The tube 1 and rack 3 assembly is free to slide in the housing 2 within a controlled distance which is limited by a stop pin 4 located in the housing 2. Outer adjustment limits of the tube 1 are provided by, in one case the action of an integral tab 1A on the tube 1 contacting the

stop pin 4, and in the other case the action of one end of the rack 3 contacting the stop pin 4.

The outer tube 1 is normally clamped in the housing 2 by the locking means which incorporates a pivot shaft 5 operated by a lever 6, the pivot shaft 5 incorporating a cam 7, the cam 7 lifting a toothed slipper 8 into locking engagement with the rack 3. A flat spring 9 is interposed between the cam 7 and toothed slipper 8 to distribute the force applied by the cam 7 over the face of the slipper 8 in which it is in contact. Means (not shown) in the region of the lever 6 is provided releasably to retain the locking mechanism in a locked condition. In this condition, the outer tube 1 and housing 2 become a rigid combination.

The locking mechanism is disengaged by the action of unclamping by moving the lever 6 to rotate the pivot shaft 5 to rotate the cam 7 thereby allowing the toothed slipper 8 to lower. Lowering of the slipper 8 is assisted by resilient means in the form of two springs 10 to ensure complete de-meshing of the teeth of the locking mechanism.

In the event of a frontal impact crash of the vehicle, the steering column is required to collapse at a controlled rate over a specified distance. The rate of collapse is controlled by an energy absorbing device which includes a strap 11 which is secured to the locking means and, in the form illustrated, is secured to the slipper 8. The strap is wrapped around a pin 12 which is located in the housing 2. The strap 11 also is passed under the pivot shaft 5 and extends in the longitudinal direction of the housing 2 (Figure 1).

The force imparted on the steering column by the driver causes the tube 1 to slide within the housing 2 with the locking means engaged. During this sliding movement, the tube 1, rack 3, slipper 8, springs 10, spring 9 and strap 11 move in unison, the strap 7 unwrapping around the pin 12.

As movement progresses, contact between the spring 9 and cam 7 is lost and the components move onto and along platforms 13 in the housing 2, which ensures continuous meshing of the teeth of the locking means. With this movement, the tag 1A bends away on contact with the stop pin 4.

It will be appreciated that the present construction provides a cam operated mechanism effecting engagement of teeth which causes positive locking of the tube sliding within the tubular housing 2. This is in addition to the normal friction clamping employed. Additionally, the mechanism incorporates an energy absorbing collapse strap which is initially active at any point of column adjustment length, unlike known systems which only become active after the column has collapsed to its shortest adjustment length.

#### Claims

1. A vehicle steering column adjustment and energy absorbing mechanism comprising a steering col-

umn part (1) slidably mounted in a support member (2), said steering column part carrying first locking means (3) for releasable engagement with second locking means (8), characterised in that it comprises cam means (7) to cause said first and second locking means to engage with one another to lock the steering column relatively to said support member; said second locking means (8) being joined to an energy absorbing device comprising an elongate member (11) arranged around a further member (12) over which said elongate member can be drawn, the arrangement being such that, in normal use, said steering column part (1) can be slidably adjusted relative to said support member (2) and locked in a desired position by said first and second locking means (3, 8) and, in the event of vehicle crash with said first and second locking means locked together, energy imparted to said steering column part moves said steering column part to cause said first and second locking means to draw said elongate member (11) around said further member, thereby to absorb energy; and there being means (13) for maintaining said first and second locking means in locking engagement in the event of a vehicle crash.

2. A mechanism according to claim 1, wherein said means for maintaining said first and second locking means in locking engagement is said support member, which has a platform portion (13).
3. A mechanism according to claim 2, wherein said platform portion (13) is a raised portion of said support member.
4. A mechanism according to claim 1, 2 or 3, in which said steering column part is an outer tube or shaft (1) of the steering column.
5. A mechanism according to any one of the preceding claims, wherein said support member is a tubular housing (2) for rigid attachment to the vehicle.
6. A mechanism according to any one of the preceding claims, wherein said first locking means is a rack (3) fixed to said steering column part and said second locking means is a toothed slipper (8) for releasable engagement with said rack.
7. A mechanism according to any one of the preceding claims, wherein said cam means (7) is an integral part of a pivot shaft (5) to which an actuating member (6) is attached in order to rotate the cam means to bring said second locking means (8) into and out of engagement with said first locking means (3).
8. A mechanism according to any one of the preced-

- ing claims, wherein a spring (9) is interposed between said cam means (7) and said second locking means to transfer and distribute force applied by said cam means to said second locking means.
9. A mechanism according to any one of the preceding claims, wherein resilient means (10) is provided between said first and second locking means (3, 8) to urge said second locking means out of engagement with said first locking means when the cam means is positioned to allow this to happen.
10. A mechanism according to any one of the preceding claims, wherein said elongate member (11) of the energy absorbing device is joined to said second locking means (8).
11. A mechanism according to any one of the preceding claims, wherein said energy absorbing elongate member (11) is a metal strap or wire.
12. A mechanism according to any one of the preceding claims, wherein said further member over which said elongate member can be drawn is a pin (12) or the like fixed relatively to said support member.
13. A mechanism according to any one of the preceding claims, wherein stop means (4) is provided to limit adjustment of the steering column part relatively to said support member in which it is mounted.
14. A mechanism according to claim 13, wherein said stop means comprises a stop member provided by a collapsible tab (1A) on said steering column part which, at one adjustment limit comes into contact with part (4) of said support member.
15. A mechanism according to claim 14, wherein said stop means further comprises a second stop member for an opposite adjustment limit of said steering column part, said second stop member being provided by said first locking means (3), part of which being arranged to abut the same part (4) of said support member as the firstmentioned stop member.
16. A vehicle incorporating a vehicle steering column adjustment and energy absorbing mechanism according to any one of the preceding claims.
- Patentansprüche
- Einstell- und Energieaufnahmemechanismus für eine Fahrzeuglenksäule, mit einem Lenksäulenteil (1), der gleitfähig in einem Stützglied (2) angebracht ist, wobei der Lenksäulenteil eine erste Verriegelungseinrichtung (3) zum lösbarer Eingriff mit einer zweiten Verriegelungseinrichtung (8) hat, dadurch gekennzeichnet, daß er eine Nockeneinrichtung (7) aufweist, um die ersten und zweiten Verriegelungseinrichtungen zu veranlassen, miteinander in Eingriff zu kommen, um die Lenksäule relativ zu dem Stützglied zu verriegeln, wobei die zweite Verriegelungseinrichtung (8) mit einer Energieaufnahmeeinrichtung verbunden ist, die ein längliches Glied (11) aufweist, das um ein weiteres Glied (12) herum angeordnet ist, über welches das längliche Glied gezogen werden kann, wobei die Anordnung derart getroffen ist, daß beim normalen Gebrauch der Lenksäulenteil (1) gleitfähig relativ zu dem Stützglied (2) eingestellt und in einer gewünschten Stellung durch die ersten und zweiten Verriegelungseinrichtungen (3, 8) verriegelt werden kann und im Falle eines Fahrzeugcrashs, wenn die ersten und zweiten Verriegelungsglieder miteinander verriegelt sind, auf die Lenksäule aufgebrachte Energie den Lenksäulenteil bewegt, um die ersten und zweiten Verriegelungseinrichtungen zu veranlassen, das längliche Glied (11) um das weitere Glied herum zu ziehen, um dadurch Energie zu absorbieren; und daß eine Einrichtung (13) vorgesehen ist, um die ersten und zweiten Verriegelungseinrichtungen im Falle eines Fahrzeugcrashs in Verriegelungseingriff zu halten.
  - Mechanismus nach Anspruch 1, bei dem die Einrichtung zum Halten der ersten und zweiten Verriegelungseinrichtungen in Verriegelungseingriff das Stützglied ist, das einen Plattformteil (13) hat.
  - Mechanismus nach Anspruch 2, bei dem der Plattformteil ein vorstehender Abschnitt des Stützglieds ist.
  - Mechanismus nach Anspruch 1, 2 oder 3, bei dem der Lenksäulenteil ein äußeres Rohr oder eine Welle (1) der Lenksäule ist.
  - Mechanismus nach einem der vorhergehenden Ansprüche, bei dem das Stützglied ein rohrförmiges Gehäuse (2) zur starren Befestigung an dem Fahrzeug ist.
  - Mechanismus nach einem der vorhergehenden Ansprüche, bei dem die erste Verriegelungseinrichtung eine Zahnstange (3) ist, die an dem Lenksäulenteil befestigt ist, und die zweite Verriegelungseinrichtung ein verzahntes Schiebeglied (8) zum lösbarer Eingriff mit der Zahnstange ist.
  - Mechanismus nach einem der vorhergehenden Ansprüche, bei dem die Nockeneinrichtung (7) ein integraler Teil eines Schwenkzapfens (5) ist, an dem ein Betätigungslied (6) befestigt ist, um die

- Nockeneinrichtung zu verdrehen, um die zweite Verriegelungseinrichtung (8) in und außer Eingriff mit der ersten Verriegelungseinrichtung (3) zu bringen.
8. Mechanismus nach einem der vorhergehenden Ansprüche, bei dem eine Feder (9) zwischen der Nockeneinrichtung (7) und der zweiten Verriegelungseinrichtung zwischengeschaltet ist, um eine durch die Nockeneinrichtung aufgebrachte Kraft auf die zweite Verriegelungseinrichtung zu übertragen und zu verteilen.
9. Mechanismus nach einem der vorhergehenden Ansprüche, bei dem ein nachgiebiges Mittel (10) zwischen der ersten und der zweiten Verriegelungseinrichtung (3, 8) vorgesehen ist, um die zweite Verriegelungseinrichtung außer Eingriff mit der ersten Verriegelungseinrichtung zu drücken, wenn die Nockeneinrichtung so eingestellt ist, daß sie dies gestattet.
10. Mechanismus nach einem der vorhergehenden Ansprüche, bei dem das längliche Glied (11) der Energieabsorbier-Vorrichtung mit der zweiten Verriegelungseinrichtung (8) verbunden ist.
11. Mechanismus nach einem der vorhergehenden Ansprüche bei dem das energieabsorbierende längliche Glied (11) ein Metallstreifen oder -draht ist.
12. Mechanismus nach einem der vorhergehenden Ansprüche, bei dem das weitere Glied, über welches das längliche Glied gezogen werden kann, ein Stift (12) oder dergleichen ist, der relativ zu dem Stützglied fest ist.
13. Mechanismus nach einem der vorhergehenden Ansprüche, bei dem ein Anschlag (4) vorgesehen ist, um die Einstellung des Lenksäulenteils relativ zu dem Stützglied zu begrenzen, in welchem es angebracht ist.
14. Mechanismus nach Anspruch 13, bei dem der Anschlag ein Anschlagglied aufweist, das durch eine verformbare Lasche (1A) an dem Lenksäulenteil gebildet ist, die an einer Einstellgrenze in Berührung mit dem Teil (4) des Stützglieds kommt.
15. Mechanismus nach Anspruch 14, bei dem der Anschlag ferner ein zweites Anschlagglied für eine entgegengesetzte Einstellgrenze des Lenksäulenteils aufweist, wobei das zweite Anschlagglied durch die erste Verriegelungseinrichtung (3) gebildet ist, von der ein Teil so angeordnet ist, daß er an dem gleichen Teil (4) des Stützglieds anschlägt wie das zuerst genannte Stützglied.
16. Fahrzeug mit einem Einstell- und Energieaufnahmemechanismus für eine Lenksäule entsprechend einem der vorhergehenden Ansprüche.
- 5 Revendications**
- Mécanisme de réglage et d'absorption d'énergie pour colonne de direction de véhicule, comportant une partie de colonne de direction (1) montée de façon coulissante dans un élément de support (2), ladite partie de colonne de direction portant des premiers moyens de blocage (3) pour un engagement libérable avec des seconds moyens de blocage (8), caractérisé en ce qu'il comporte des moyens à came (7) destinés à amener lesdits premiers et seconds moyens de blocage à s'engager afin de bloquer la colonne de direction par rapport audit élément de support ; lesdits seconds moyens de blocage (8) étant reliés à un dispositif d'absorption d'énergie comportant un élément allongé (11) disposé autour d'un autre élément (12) pardessus lequel ledit élément allongé peut être tiré, l'agencement étant tel que, en utilisation normale, ladite partie de colonne de direction (1) peut être ajustée de façon coulissante par rapport audit élément de support (2) et bloquée dans une position souhaitée par lesdits premiers et seconds moyens de blocage (3, 8) et, dans le cas d'un accident de véhicule avec lesdits premiers et seconds moyens de blocage bloqués, l'énergie appliquée sur ladite partie de colonne de direction déplace ladite partie de colonne de direction afin d'amener lesdits premiers et seconds moyens de blocage à tirer ledit élément allongé (11) autour dudit autre élément, afin d'absorber ainsi l'énergie ; et en ce qu'il y a des moyens (13) destinés à maintenir lesdits premiers et seconds moyens de blocage en engagement de blocage dans le cas d'un accident de véhicule.
  - Mécanisme selon la revendication 1, dans lequel lesdits moyens destinés à maintenir lesdits premiers et seconds moyens de blocage en engagement de blocage sont constitués par ledit élément de support, qui possède une partie de plate-forme (13).
  - Mécanisme selon la revendication 2, dans lequel ladite partie de plate-forme (13) est une partie relevée dudit élément de support.
  - Mécanisme selon la revendication 1, 2 ou 3, dans lequel ladite partie de colonne de direction est un tube ou arbre extérieur (1) de la colonne de direction.
  - Mécanisme selon l'une quelconque des revendications précédentes, dans lequel ledit élément de support est un boîtier tubulaire (2) pour fixation

- rígide sur le véhicule.
6. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel lesdits premiers moyens de blocage sont constitués par une crémaillère (3) fixée sur ladite partie de colonne de direction et lesdits seconds moyens de blocage sont constitués par un élément coulissant denté (8) pour engagement libérable avec ladite crémaillère. 5
7. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens à came (7) font partie intégrante d'un arbre de pivotement (5) sur lequel est fixé un élément d'actionnement (6) afin de faire tourner les moyens à came de façon à amener lesdits seconds moyens de blocage (8) en et hors d'engagement avec lesdits premiers moyens de blocage (3). 10
8. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel un ressort (9) est interposé entre lesdits moyens à came (7) et lesdits seconds moyens de blocage afin de transférer et répartir la force appliquée par lesdits moyens à came sur lesdits seconds moyens de blocage. 20
9. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel des moyens élastiques (10) sont prévus entre lesdits premiers et seconds moyens de blocage (3, 8) afin de pousser lesdits seconds moyens de blocage hors d'engagement avec lesdits premiers moyens de blocage lorsque les moyens à came sont positionnés afin de permettre que ceci se produise. 25
10. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel ledit élément allongé (11) du dispositif d'absorption d'énergie est relié aux dits seconds moyens de blocage (8). 30
11. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel ledit élément allongé d'absorption d'énergie (11) est une bande ou un fil métallique. 35
12. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel ledit autre élément par-dessus lequel peut être tiré ledit élément allongé est un axe (12) ou équivalent fixe par rapport audit élément de support. 40
13. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel des moyens de butée (4) sont prévus pour limiter le réglage de la partie de colonne de direction par rapport audit élément de support dans lequel elle est montée. 50
14. Mécanisme selon la revendication 13, dans lequel lesdits moyens de butée comportent un élément de butée procuré par une patte escamotable (1A) sur ladite partie de colonne de direction qui, au niveau d'une limite de réglage, vient en contact avec une partie (4) dudit élément de support. 55
15. Mécanisme selon la revendication 14, dans lequel lesdits moyens de butée comportent en outre un deuxième élément de butée pour une limite de réglage opposée de ladite partie de colonne de direction, ledit deuxième élément de butée étant procuré par lesdits premiers moyens de blocage (3), dont une partie est prévue pour buter contre la même partie (4) dudit élément de support (2) que l'élément de butée mentionné en premier.
16. Véhicule incorporant un mécanisme de réglage et d'absorption d'énergie pour colonne de direction de véhicule selon l'une quelconque des revendications précédentes.

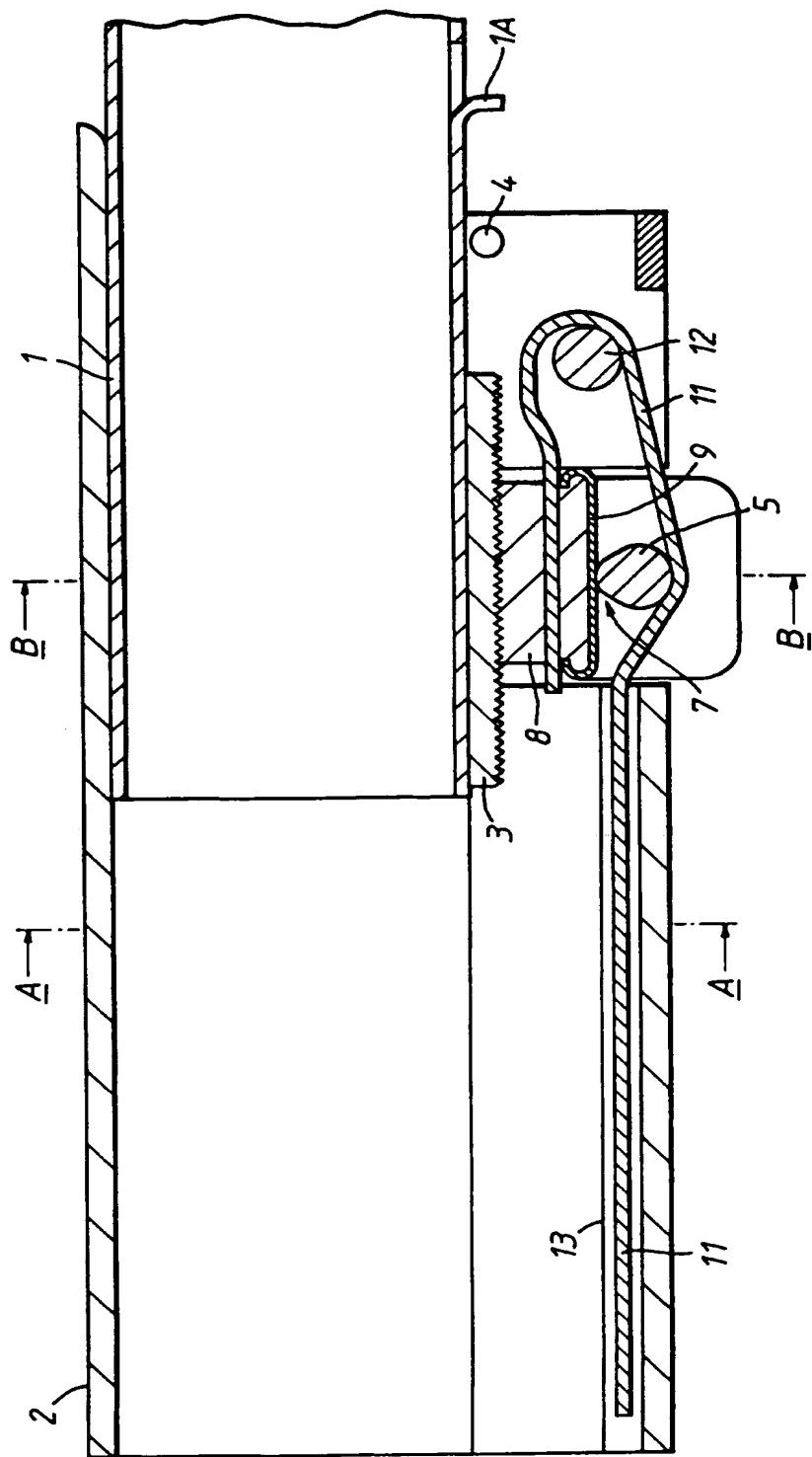


Fig.1

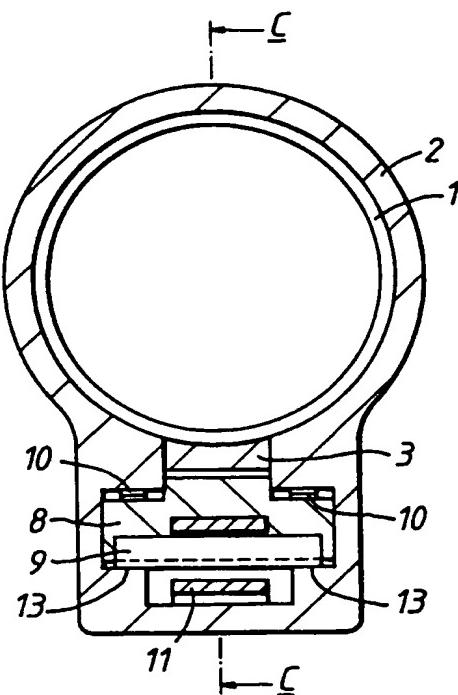


Fig.2

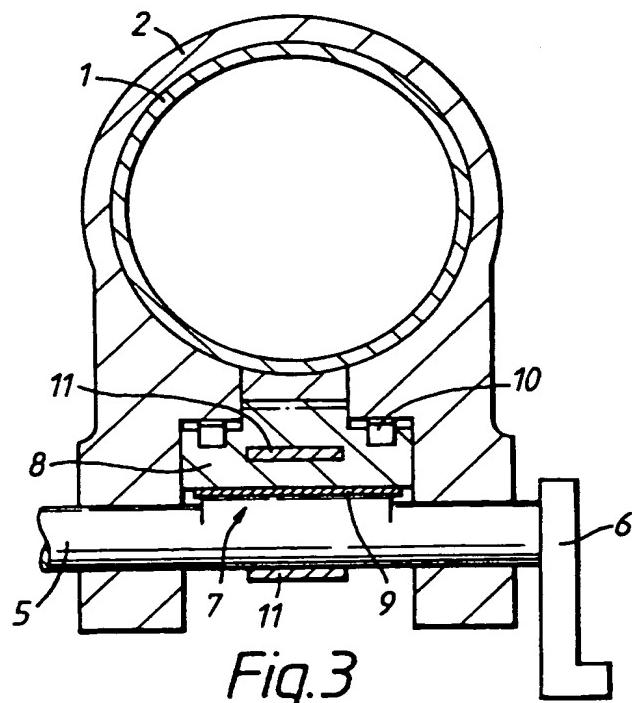


Fig.3